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Formal quality assessment of Crisis Maps produced during 2005-2010

Preliminary results and a proposal for rapid and cost-effective quality assessment

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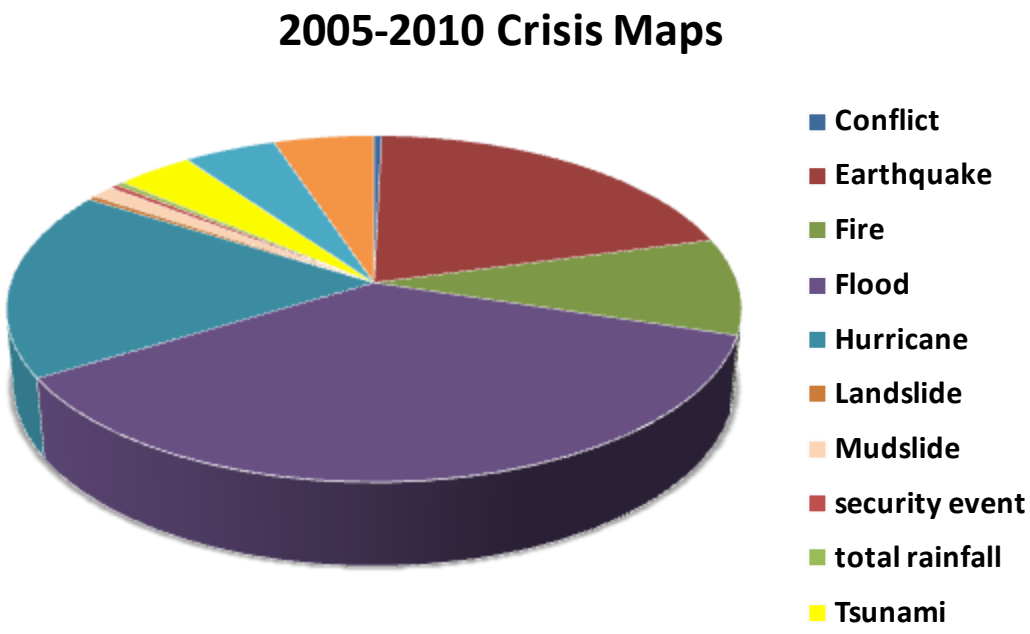

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Abstract

In the last decade, crisis maps have become increasingly a common support in the disaster preparedness and response cycle. In this work, five years of crisis maps from five world leader service providers have been explored and a way to extensively and quickly verify their quality is proposed. A sample of 255 maps has been assessed according to a checklist designed. The clarity of the content, the readability and usability of the maps and the respect of main cartographic standards have been assessed. The first analysis presented in this document highlighted that the basic characteristics expected in good maps are not always respected. The aim of showing current shortcomings in the crisis maps to the scientific community is to foster the improvement of their quality in the future.

Introduction

As a result of advances in Earth Observation technologies, thousands of crisis maps are being produced every year to support crisis preparedness for response operations in case of events affecting the population, the infrastructures and the environment.
The aim of this study is twofold:

1. define a procedure allowing a rapid and cost-effective assessment of crisis maps' quality, in particular without the need of reference data;
2. extensively apply the procedure to a large quantity of maps produced in response to real events, in order to give a landscape of the actual status of crisis maps' quality and foster their improvement.

In this work, the last five years of crisis maps, produced by five Service Providers and available for internet download, have been taken into account, in order to assess their quality, from a formal point of view. This means to visually evaluate the features of the maps, including checking if the cartographic standards are aptly applied, if the maps are readable and the information is understandable.
This analysis cannot be considered as a validation, since validation can be defined as a producer-independent process generating documented evidence to which degree the object subject to validation reaches predetermined requirements. For this work, users' requirements for each map commissioning are unknown and ground truth is not available to check spatial and thematic accuracy. For those reasons the analysis presented in this document is considered as a formal quality assessment.
A checklist including around forty entries has been designed to assess the maps' quality: these entries explore the minimal set of requirements needed for the integration of the crisis information into Geographic Information Systems. The checklist has been derived from the Validation Protocol (Broglia et al.,2010) developed at JRC and adopted for the SAFER FP7 project crisis maps validation.
The checklist has been used by 11 trained experts of maps. At this stage of the research, 13% of the considered maps (255 maps out of 2009) has been verified.

Crisis Maps production 2005-2010

In this study, the crisis map production is considered starting from the Indonesian Tsunami of December 2004, after which the emergency map production increased significantly, up to the Haiti earthquake of January 2010. Five years of emergency mapping experience are covered, between two major events that have hit the population, the local economy and the public opinion. These maps represent a patrimony of our recent history both from a cartographic and an Emergency Response Services point of view.
Five world leader Service Providers (SPs), who provide online copies of their maps, have been taken into account. It has been decided to keep them anonymous, since the purpose of this research is to highlight the importance and the evolution of crisis maps' quality during the last years and not to

evaluate the single SP performance. Only maps freely available online for download have been considered.
A total amount of 2009 maps have been downloaded from the five SPs websites, covering the period from December 2004 to January 2010. The maps have been classified with respect to the type of crisis: conflict, earthquake, fire, flood, hurricane, landslide, oil pollution, sanitarian crisis, tsunami, typhoon and a class "other" for the crises not comprised in these typologies. The maps have been classified considering the year of production as well (see Table 1), to be able to explore the evolution in time of their main characteristics.

Count of ID	Year							
Type of event	2004	2005	2006	2007	2008	2009	2010	Grand Total
Conflict		4	9	1	61	70		145
Earthquake		63	28	14	14	107	104	330
Fire		15	1	45	13	53		127
Flood		104	122	144	198	174	14	756
Hurricane		48		59	168	7		282
Landslide			3					3
Oil_pollution			9	2				11
Sanitarian_crisis		2	3					5
Tsunami	4	208		10		3		225
Typhoon				2		59		61
Other		14	13	12	9	15	1	64
Grand Total	**4**	**458**	**188**	**289**	**463**	**488**	**119**	**2009**

Table 1 – "Population" of crisis maps considered in this study (December 2004 - January 2010).

Table 1 shows an increase in map production through years. The exceptions are the year 2005, during which most of the maps related to the December 2004 tsunami have been produced and the year 2010, which includes only January.
The majority of maps cover flood events, i.e. 37% of total, followed by earthquakes, which represent 16% of the population of considered maps.

Formal assessment: the checklist

To obtain a quantitative evaluation of the quality of maps over time, a checklist has been designed and it has been applied by a group of 11 trained validation experts, inside the ISFEREA team of the GlobeSec Unit, JRC, EC.
This checklist is derived from the Validation Protocol (Broglia et al.,2009) that has been developed at JRC and already applied in the framework of the SAFER – FP7 project (JRC,2009; JRC,2009). To perform a complete validation of a map, a significant effort is required and a crucial issue is the availability of reference data to be able to assess positional and thematic accuracy. In this case, the purpose was not to perform a complete validation, but to check - in a fast and cost-effective way - as many parameters as possible from a "formal" point of view, with the aim of covering a major part of the maps produced between December 2004 and January 2010 and to give a landscape of maps quality and, if possible, of their evolution over time. So, among all the parameters presented in the validation protocol, only the ones that can be evaluated just by analyzing visually the maps, without any ground truth, have been taken into account and eventually adapted to the purpose. Validation is supposed to verify if the product fulfils users' (usually purchasers') requirements. In this case it is not possible to know, for each case, which were the specific requirements, so it has been checked if the general cartographic and common use standards were respected, according to the JRC validation team experience.

In particular, attention has been focused on map readability and usability; anyway all the validation categories defined in the protocol have been taken into account in the checklist, these categories are: Reliability of the information content, Consistency of the information support and Usability of the product.
Another purpose of the checklist was to store enough maps' information to build a database of crisis maps to archive and retrieve them in an efficient way.
In the following table the complete list of the fields that have been checked on each map is presented:

Validation protocol category	Sub-categories	Field
	Unique identifier	ID
Usability		Link to the map
	Who	Service Provider
	What	Type of crisis event
		Type of map
	When	Date of crisis event (Month and year)
		Date of map production (Month and year)
		Date of crisis event (Day, if present)
		Date of map production (Day, if present)
	Where	Place of crisis event - Continent
		Place of crisis event - Country
		Place of crisis event - town
	Language	First Language of the map
		Second language of the map
Reliability of the information content		Information on occlusion of EO sources (clouds, artifacts)
		Time gap between crisis event and crisis image - Value
		Time gap between crisis event and crisis image - Unit
		Legend semantic definition for thematic data (e.g. Corine Landcover)
Consistency of the information support		Spatial resolution of EO source (in meters)
		Consistency between map and legend symbols
Usability	Readability	Contrast between background and thematic entities
		Symbols easily differentiable
		Scale bar
		Declared scale
		Presence of overview map
		Coordinate Graticules/Grid and its labels
		Presence of interpretation text
		Presence of map title
		Completeness of title: information on geographical area, date of event, thematic content
		Type of map background
		Type of sensor used for information extraction (e.g. flood mask)
		Printing size
	Who	Presence of name of producer
		Information on conditions related to access, use and information sharing
		Responsibility assumption (on a dataset or information sources)

Validation protocol category	Sub-categories	Field
	Metadata	Metadata - Description of data sources used
		Metadata - description of processing steps
		Metadata - information on quality control procedure used
		Metadata - information on known sources of error
		Metadata - information on spatial accuracy
		Metadata - information on thematic accuracy
		Metadata - point of contact
		Metadata - reference datum
		Metadata - reference projection
		Glide Number (When available) e.g. EQ-2010-000009-HTI
		Consistency between declared scale and resolution of the images used to produce the map
		Created By
		Modified By

Table 2 – List of fields considered in the map validation form

As it can be noticed looking at Table 2, many aspects have been checked:

a) The presence of main information regarding the event, answering the fundamental questions "Who?" (Who is the Service Provider?), "What?" (Which type of event did occur?), "Where?" (Continent, Country and Town where the event occurred), "When?" (The date when the event occurred), the completeness of the information included in the title and the presence of interpretation text.

b) The readability of the map, concerning for example the type of background: in fact usually crisis maps are characterised by a main thematic layer representing the crisis situation or damage assessment, e.g. flooded area, burnt area, and on the background usually there is a topographic map or a satellite image, sometimes with some reference layers, such as roads or cities. So it has been assessed which type of background is displayed, and if the contrast between the background and the main thematic layer is good or not. The contrast between background and thematic entities can be an important issue for users, regarding usability. Often in emergency maps the background is represented by a satellite image. It is however preferred to have, when possible, a topographic map as background, because this helps to improve the readability of the map. In addition to the background check, the presence and the clarity of the legend and of symbols have been checked.

c) Since it has not been possible to check the positional accuracy of the maps, it has been considered important to be able to verify at least wheter the declared scale of the map is consistent with the resolution of the data used to produce the map. According to cartographic standards, the declared scale should correspond to a given planimetric accuracy (American Society for Photogrammetry and Remote Sensing (ASPRS) Specifications Standards Committee,1990). This is to be tested in particular for topographic maps, but since there are no different definitions regarding thematic maps, these standards should be considered as a reference for any kind of map, at least respecting the order of magnitude of the accuracy required for a specific scale. If, for special reasons (e.g. explicit users' requirements, problems due to data availability or time constraints), they cannot be fulfilled, it should be clearly mentioned on the map, otherwise a misuse of the map can occur. It is mainly for verifying this aspect that the resolution of the satellite images used to produce the map

has been stored. Besides of course it has been checked if the declared scale and/or the scale bar are shown.

d) Some details regarding metadata have been checked, since the user should be aware about the quality and the characteristics of the product that he has in hand. The following aspects have been checked: the declaration of quality and accuracy of the map, the cartographic datum and projection definition and the SP's contact. From the cartographic point of view the presence of the declaration of the reference datum and projection is fundamental, together with the possibility to read the coordinates on the map thanks to a proper graticule.

e) A global evaluation of the formal quality of the maps has been made. Twenty-five parameters have been selected from the checklist, taking into account the ones describing the (formal) qualities of the maps; for example the parameter "Completeness of title" has been considered for this evaluation, while the parameter "First Language of the map" has not. Each parameter has been evaluated as fulfilled or not fulfilled with respect to a given threshold; for example the parameter "Symbols are easily differentiable" has been considered as fulfilled if the answer was "Good" and not fulfilled otherwise (see Annex 2 for a complete list of each parameter's values and to see when they have been considered as fulfilled). Finally, for each map, the number of fulfilled parameters has been counted.

The checklist has been managed online, on the ISFEREA intranet, so all the validation experts could access the same database. To ensure homogeneity in terminology and to reduce mistakes in data entry, most of the fields had to be filled using a drop-down list, and a "guide to the formal assessment checklist" was available on line as well (see Annex 1).

First results after the check of a sample of 255 maps

A first sample of 255 maps has been randomly extracted from the considered "population" of 2009 maps. Then the checklist has been filled by 11 different validation experts, each evaluating different maps. In the following the first results of the check are presented.

a) First of all, the presence of the main information regarding the event has been checked. It has been possible to notice that:

   - In 60% of cases the information included in the title is not complete. It has been considered complete if the geographical area, the date of the event and the thematic content were cited.
   - In 50% of maps the interpretation text is missing.
   - In 11% of maps the Overview map is missing.

b) Regarding the readability of the map:

   - Only 16% of maps displays a Topographic map as a background[1], most of maps display a satellite image as a background.
   - In 11% of maps the Legend is missing.
   - In 31% of maps there is only partial consistency between map and legend symbols.

[1] In most of cases crisis maps show one or more thematic layers, such as the burnt area, or the flooded area, which represent the main information content of the map; as a background olayer, usually a satellite image or a topographic map is displayed, to provide a context to the thematic data. A topographic map is however preferable as a background layer, since it provides a simplified, easier to read, representation of the territory.

- In 13% of maps the Graticule is missing or incomplete.

c) Regarding the presence of the scale bar and of the declared scale and its consistency with the resolution of the image used to produce the map, an objective reference is necessary. Scientific papers considering the planimetric accuracy that can be reached using satellite images mainly refer to topographic map production or updates: for example in (Uchiyama et al.,2008; Amhar and Ade Komara,2009) it has been verified that ALOS-PRISM data (PAN 2.5m resolution at Nadir) is suitable for map generation at the 1:50000 scale and for map updating at 1:25:000 scale; in (Topan et al.,2009) the rule of thumb for topographic mapping of at least 0.1 mm of ground sampling distance in the map scale has been verified (i.e. 2.5 m resolution for 1:25000 maps, 5 m resolution for 1:50000). In (Wolfe et al.,2002) it has been verified that the geolocation accuracy of MODIS images (up to 250 m resolution at nadir) is 50 m at nadir, in this case aiming at terrestrial global change applications and not at topographic map production. It is not easy to find references for the accuracy required for thematic map production and its relation with the image resolution of all satellite sensors. According to the ASPRS and cartographic standards (American Society for Photogrammetry and Remote Sensing (ASPRS) Specifications Standards Committee,1990), the planimetric accuracy required for full quality maps is 1.25m for 1:5000 scale, 2.5m for 1:10000 scale, 5m for 1:20000 scale. For smaller scales the National Map Accuracy Standards (NMAS, (USGS,1947)) have been considered: an accuracy of 1/50 inch measured at the publication scale. In this work, the criteria applied to decide whether the resolution of the image used to produce a map at a certain scale is compatible with the accuracy required for that scale is the following: the half of the image pixel size must be less or equal than the planimetric accuracy required by ASPRS and NMAS standards. Only images with pixel size greater than 5m have been considered. The compatibility criteria is in agreement with the assumption that it is possible to orthorectify the images with an accuracy equal to half the image spatial resolution, that is feasible according to scientific literature indications (Congalton,2009), anyway assuming that this is always possible is quite optimistic. This approach has been chosen to apply cartographic standards but also to take into account that they have been conceived for topographic map production and not for satellite based thematic map production. For the time being, the VHR images have not been taken into account since their positional accuracy can vary because of many different factors (Congalton,2009). Other maps have been excluded because for some of them no satellite images were used or for some reason the image resolution information was not available. Only for 77 maps it has been possible to check the compatibility between the resolution and the scale. It has been found that:

   - For 27% of maps (out of 77 maps), the declared scale was too large with respect to the resolution of the image used to produce them.
   - 7% of maps (out of 255 maps) miss the declared scale, anyway the scale bar is practically always present. There is only one case where neither the declared scale or the scale bar are present.

d) About the presence of metadata:

   - None of the maps presented all the metadata elements that have been checked and none of the maps missed all the elements.
   - 7% of maps miss reference datum OR reference projection.
   - Almost all maps miss information about processing steps, information on quality control procedure used, information on known sources of error, thematic and spatial accuracy.
   - Almost all maps present information about point of contact.

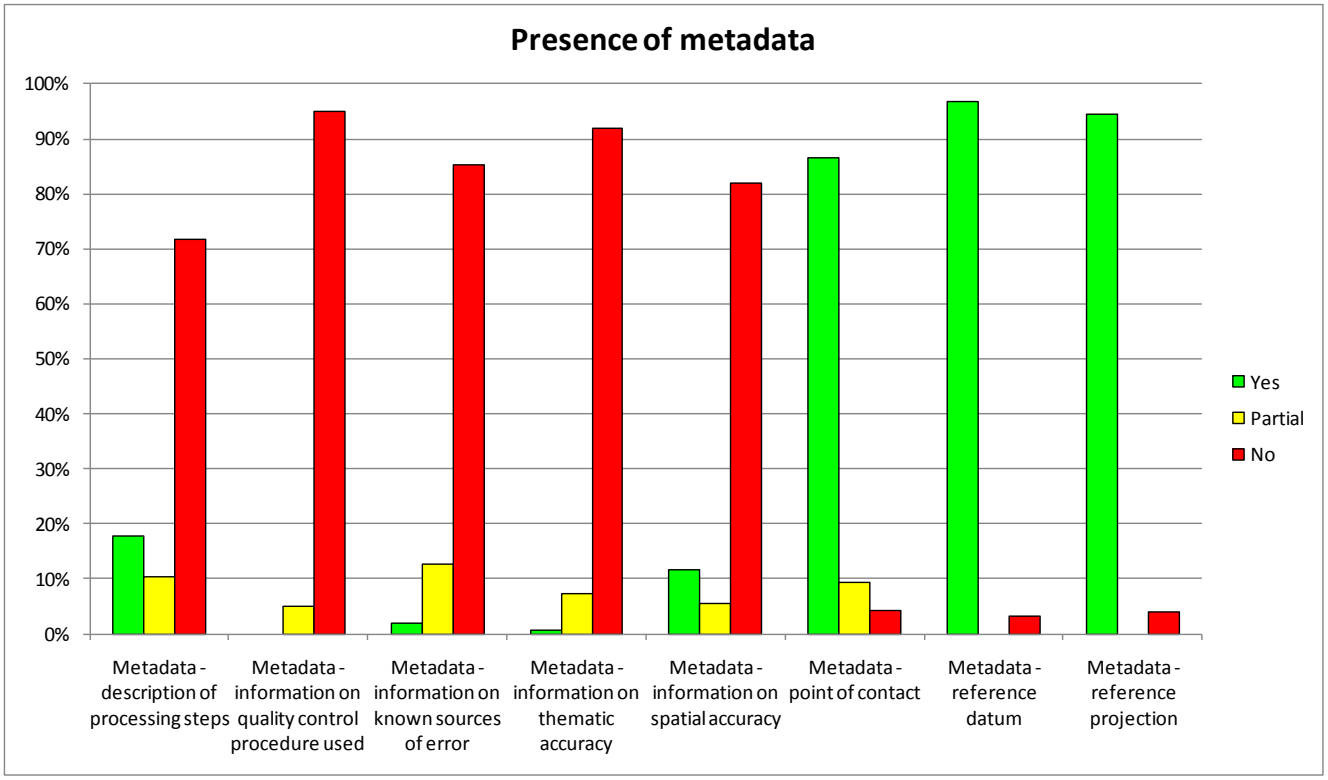

Figure 1 – Presence of some information regarding metadata on the 255 checked maps.

e) The formal quality of the 255 sampled maps has been analysed with respect to the 25 validation parameters taken from checklist as explained in the previous section. Figure 2 shows the percentage of maps fulfilling at least a given percentage of the chosen validation parameters. The most part (95%) of the maps fulfils at least 50% of the parameters. The percentage of maps which fulfils at least 80% of the parameters falls to 15%.

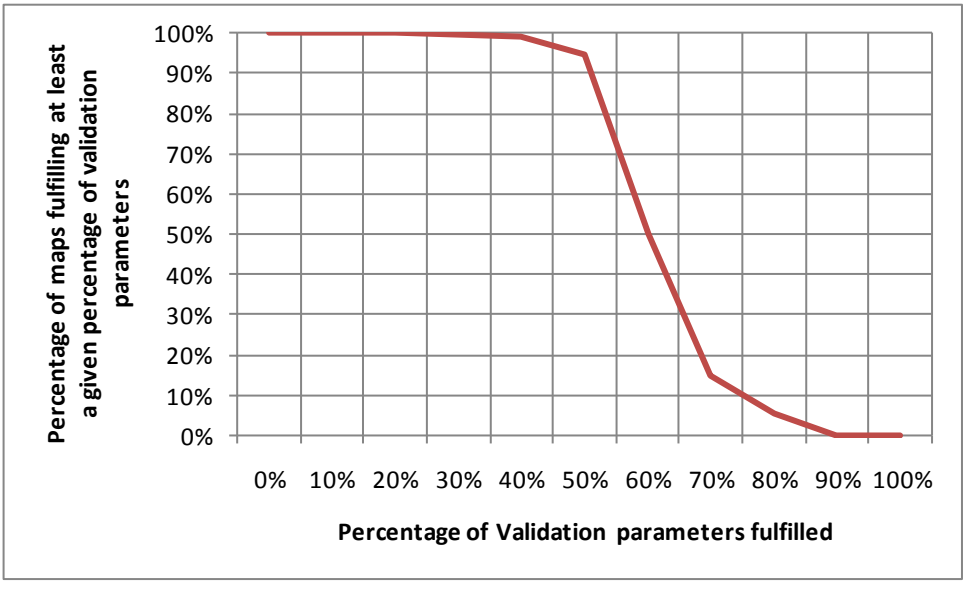

Figure 2 – Percentage of maps fulfilling (at least) a given percentage of the chosen validation parameters

Evolution over time

A few years of crisis map production (from December 2004 to January 2010) have been explored in this study, therefore it is interesting to try to interpret the evolution over time of the maps' quality.
In the following the behaviour over time of a subset of the checklists' parameters, represented in Figures from 2 to 7, is described:

- The presence of the interpretation on the map text is important, since it describes briefly the event that has occurred, the main content of the map and sometimes explains how it has been produced and with which data. In Figure 3 it is possible to notice that a sort of negative trend is visible from 2006 to 2008, but it is not confirmed towards the previous and following years.
- The title and the subtitle usually contain the main information about the crisis event. Crisis maps, which often are used in emergency cases, should provide the most relevant information in an effective way, i.e. summarizing it as much as possible in the title. Over the years explored in this study the level of completeness of the title is approximately constant (Figure 4), even if the evaluation of "No" completeness, which disappeared after 2005, appears again in the last three years.
- The presence of information on thematic accuracy, which is very useful to get an indication of the level of reliability of the main content of thematic maps, and which is part of metadata, is shown in Figure 5. The behaviour over time is essentially constant. Maybe it is possible to point out a very slight improvement given by the coming in sight of the "Yes" evaluation (from 2009), but in 2010 the "Partial" evaluation disappears, while the "No" slightly increases.
- The presence on the map of information on conditions related to the access to maps' data is very important to give users the possibility to understand if it is allowed to distribute the map content. The most common information on the conditions related to the access is the presence of the copyright symbol. This cannot be considered complete information on conditions since the presence of the copyright states only that some rules on the access exist, but it does not explain which are these rules. In emergency situations it is unlikely that users have the opportunity to call the data providers to ask further details. Therefore clear information about the data access conditions should be present on the maps. From Figure 6 it is evident that in many cases the copyright information only is present and in many other cases no information at all is present. It is also evident that there is not significant trend over time.
- As previously stated usually crisis maps are characterized by a thematic content layer on top of a background layer that can be an orthorectified satellite image or a topographic map. A good contrast between these layers is fundamental to guarantee the readability of the map. Looking at Figure 7 it is possible to notice that from 2007 onwards the proportion between maps with a Good/Fair/Bad contrast between background and thematic entities is almost constant.
- A similar pattern can be seen in Figure 8, where the consistency between the symbols appearing on the map and inside the legend is analysed: from 2008 onwards the proportion between maps with a Yes/Partial/No/Legend_is_Absent evaluation of consistency between maps and legend symbols is almost constant.
- The maps with background contrast problems or consistency problems from 2006 onwards are very few (around 5-10%), while in 2005 more problems occurred, when the huge Indonesian Tsunami emergency occurred.

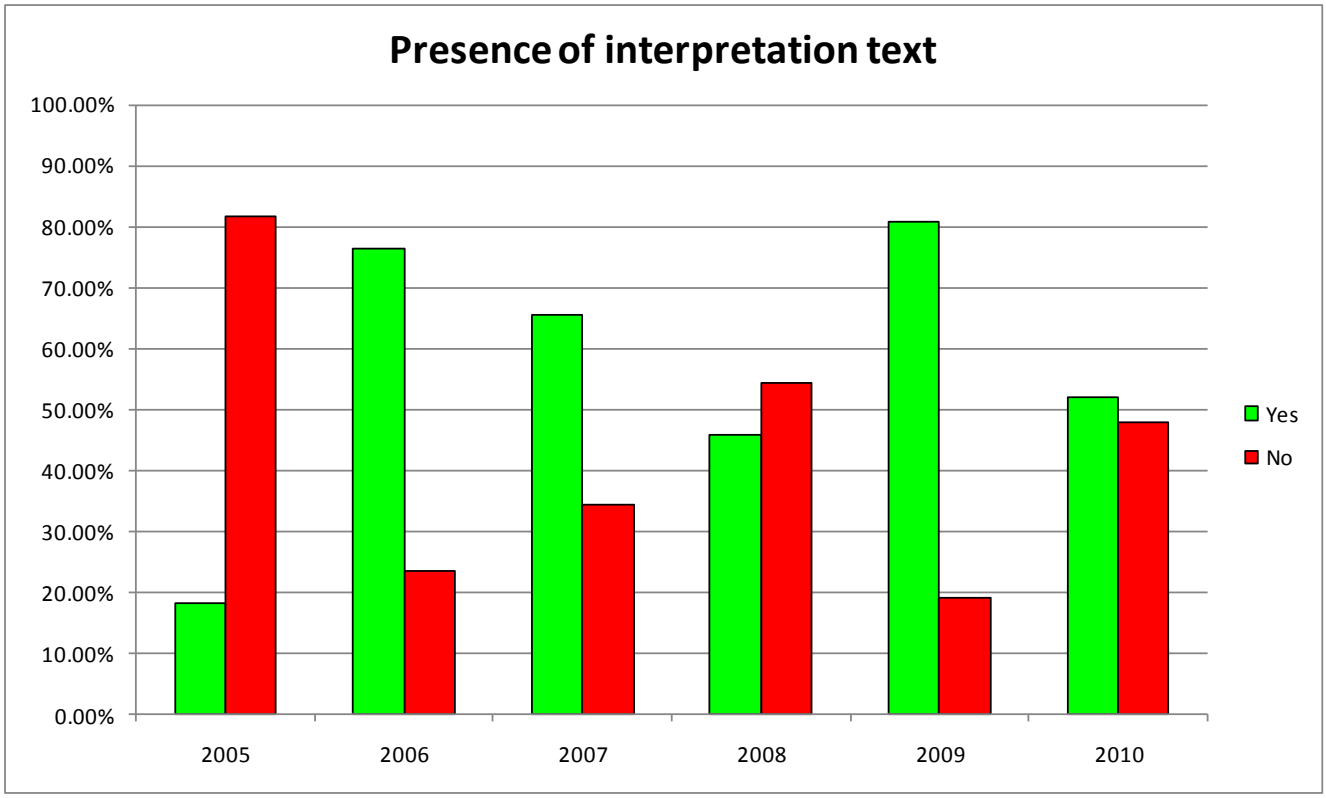

Figure 3 – Presence of interpretation text over time on the 255 checked maps

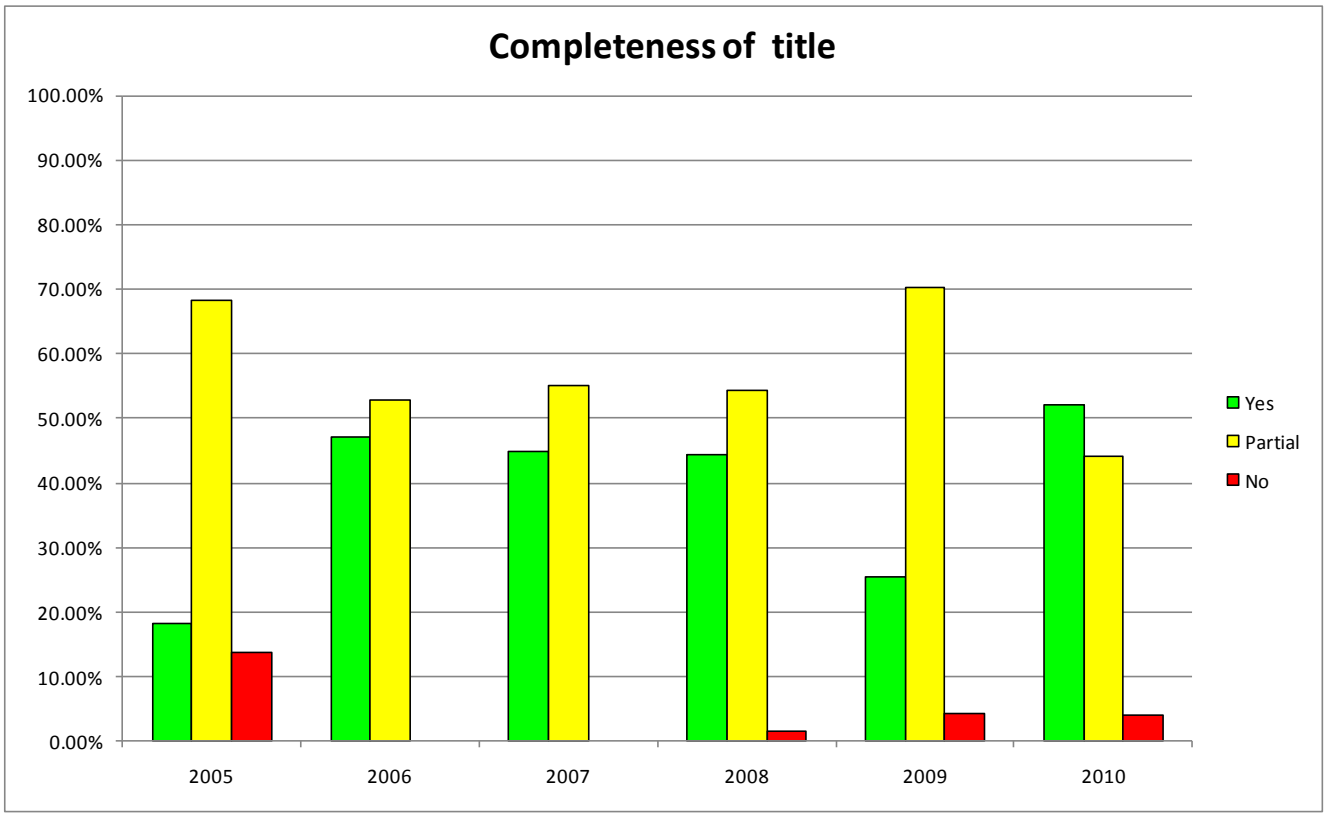

Figure 4 – Completeness of title over time on the 255 checked maps. It has been verified if the geographical area, the date of the event and the thematic content of the map were cited.

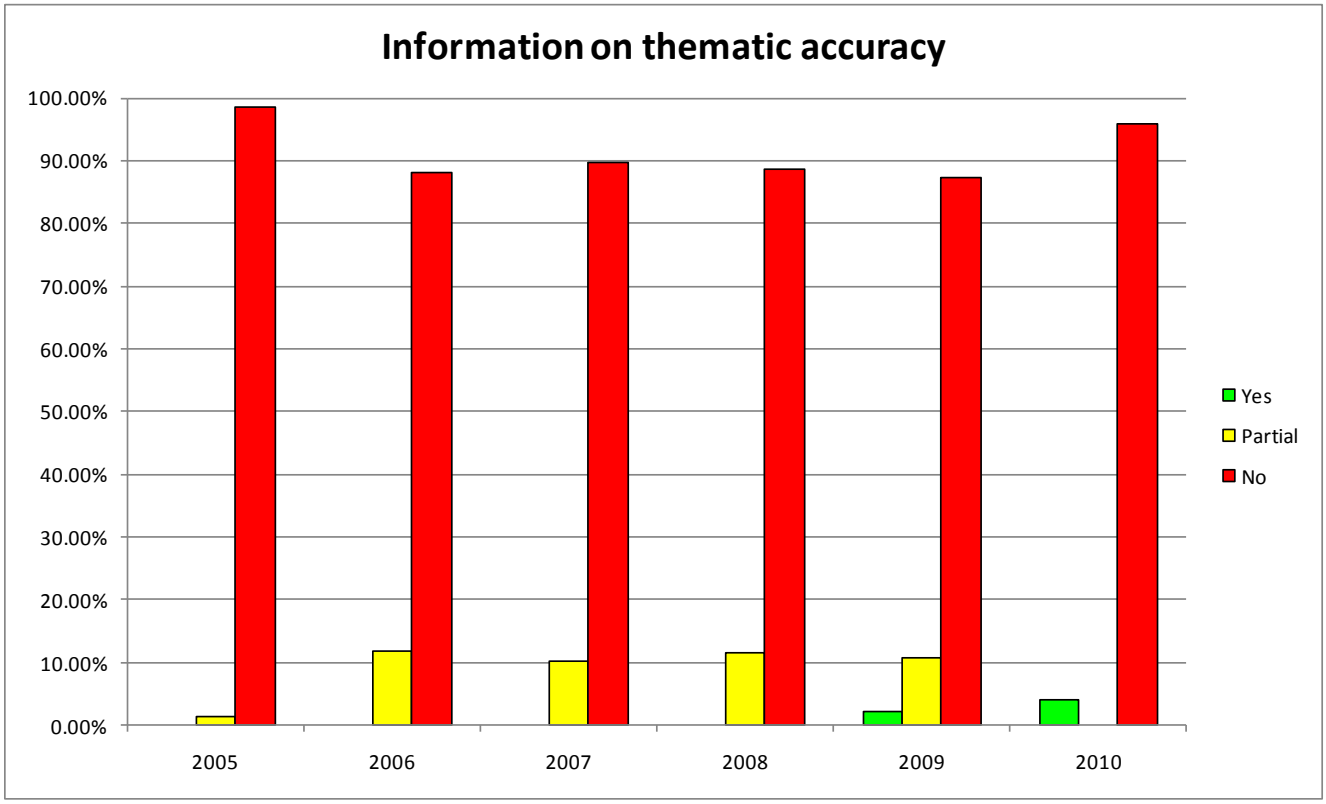

Figure 5 – Presence, on the 255 checked maps, of information on thematic accuracy.

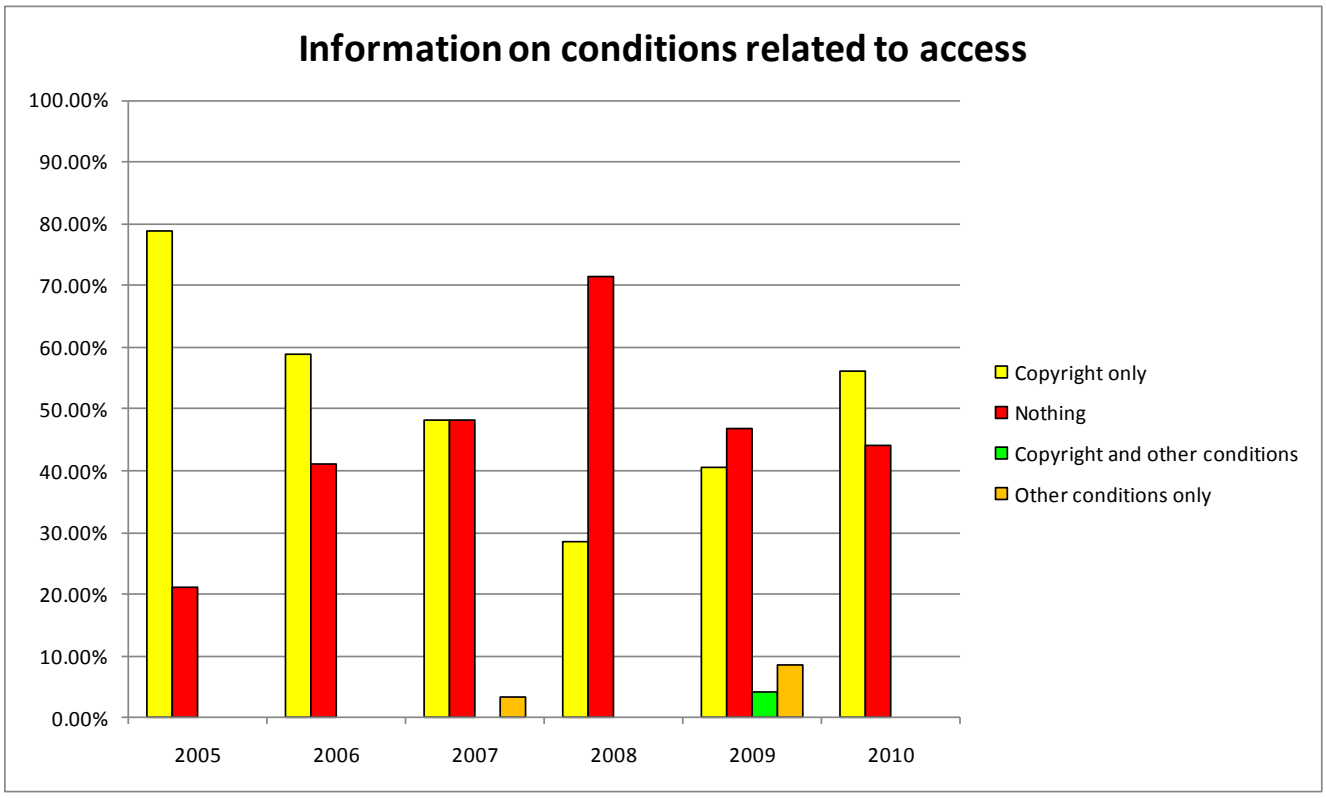

Figure 6 – Presence, on the 255 checked maps, of information on conditions related to access.

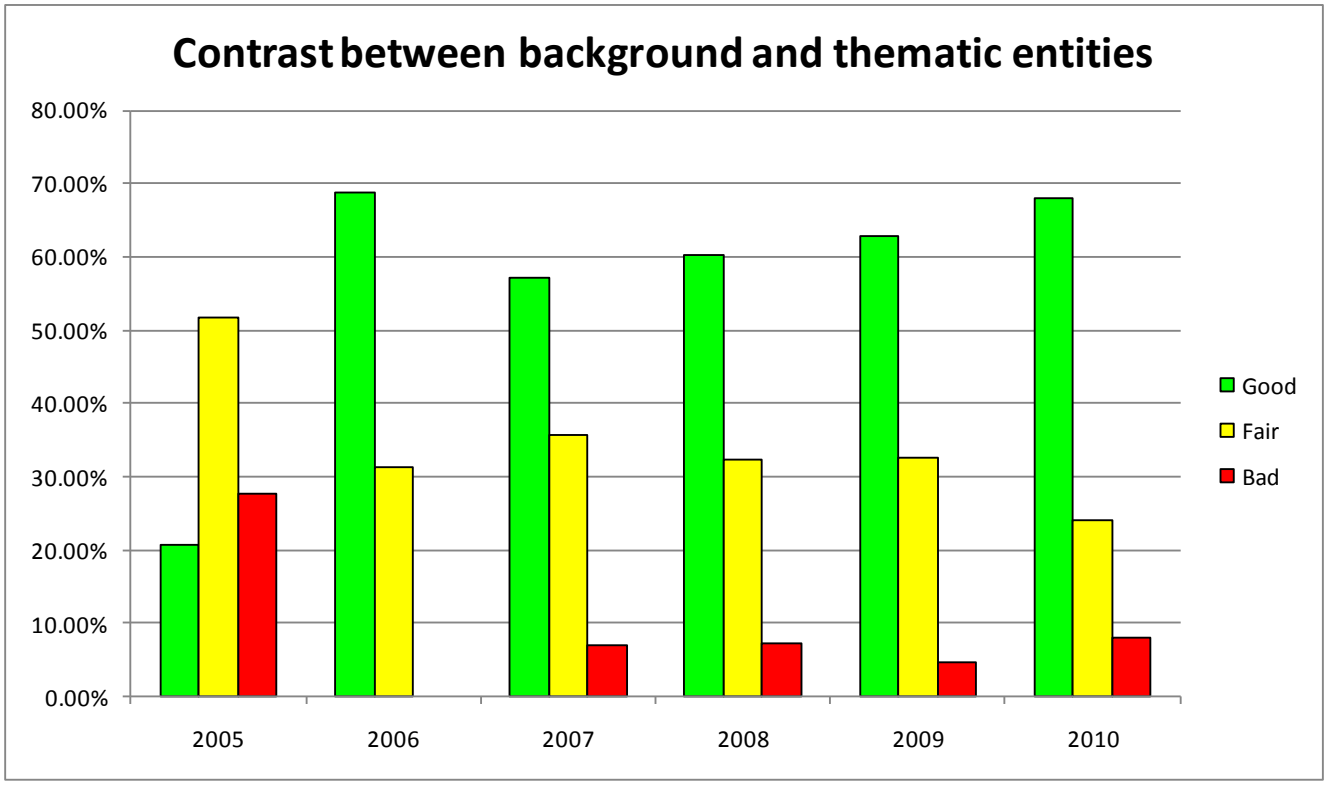

Figure 7 – Quality of contrast between background and thematic entities in the 255 checked maps.

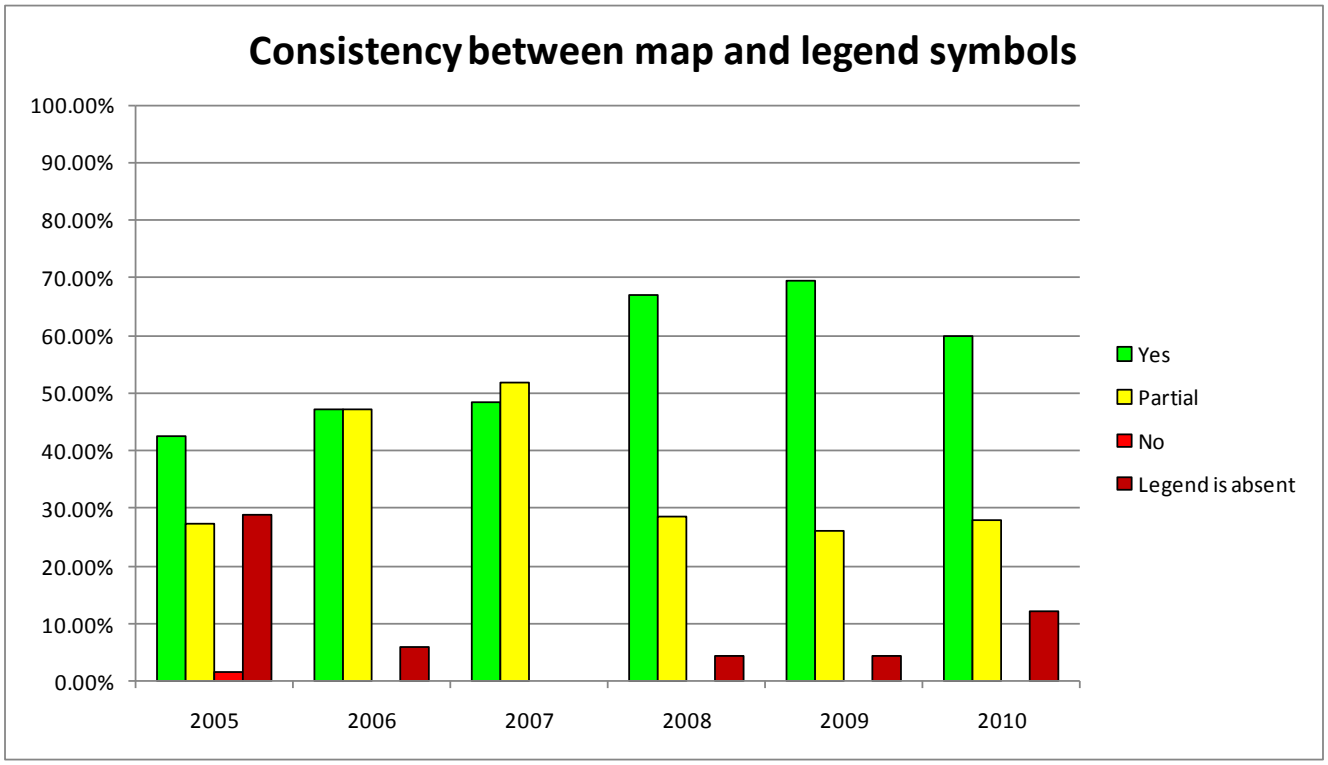

Figure 8 – Consistency between map and legend symbols in the 255 checked maps.

According to what has just been discussed about Figures from 3 to 8, it is not possible to single out a significant maps' quality trend over time, neither towards increasing quality nor decreasing. In fact, even if for some parameters a slight improvement can be noticed, for some others a slight degradation is present. In general it is possible to state that there are no important changes in the maps' quality over time, even if ample room for improvement exists, as it can be seen from the shortcomings that have been presented thus far.

Conclusions

In this study, the production of crisis maps over the last five years has been sampled and formally checked, according to a checklist derived from the Validation Protocol developed by JRC in the framework of SAFER FP7 project. The study verified whether the main cartographic standards were respected, whether the main content of each map was easy to understand and, in general, if the readability of the maps was acceptable.
At this stage of the analysis, the first results have been summarised after the check of 255 maps out of 2009. It is interesting to note that too often important information is missing.

- In 60% of the cases the information included in the title is not complete and in 50% of the maps the interpretation text is missing, this means that for one map out of two, the reader may encounter difficulties in understanding the map content and context.
- Only 16% of the maps displays a Topographic map as a background, most of the maps display a satellite image as a background, while, according to the Project Users Board of SAFER, for most of the users it is easier to interpret a map which has a topographic map as a background.
- In 11% of maps, the legend is missing and in 31% of the maps there is only partial consistency between map and legend symbols, although the majority of crisis maps is constituted by thematic maps that require a lot of attention for the legend.
- It has been verified that, for 25% of the maps, out of 77, the declared scale was too large with respect to the resolution of the image used to produce them; cartographic standards are important and should be respected for every map.
- Concerning Metadata, almost all maps show the description of the data source used, the point of contact and the reference datum and projection. Additionally, numerous maps miss information about processing steps, information on quality control procedure used, information on known sources of error, thematic and spatial accuracy.
- The greatest part (95%) of the maps fulfils at least 50% of the parameters, but when requesting to fulfil at least 80% of the parameters, the percentage of maps falls to 15%.

These preliminary results show that it is important to verify the quality of crisis maps, since relevant elements are often missing, so that in the future, gaps could be closed and the cartographic and information value could be improved. In general, it is not possible to single out an improvement or a degradation of the quality of the maps analysed over time. In the future, the authors plan to analyse the results in greater detail, and to enlarge the number of sampled maps.

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Annex 1 – Guide to the formal assessment checklist

I- Purpose of the collaborative validation exercise

The purpose of this exercise is to perform a formal check of emergency maps produced by different service providers between December 2004 and January 2010. The results will allow to study the evolution of the maps'quality through time, by service provider and by type of event.

II- Access to the maps

A database of emergency maps has been created and stored on the G drive :

G:\Arena\Emergency_maps\

It consists of **2009** maps, in .jpg, .pdf, .tif or .bmp format structured, at a first level, by type of crisis event and, at a second level, by service provider.

- Each map has an **ID** that corresponds to the first 4 digits of the maps' name as in this example:

0010_2008_DLR_20080926_haiti_hurricane_bridge_Montrouis_medium.jpg
ID = 0010

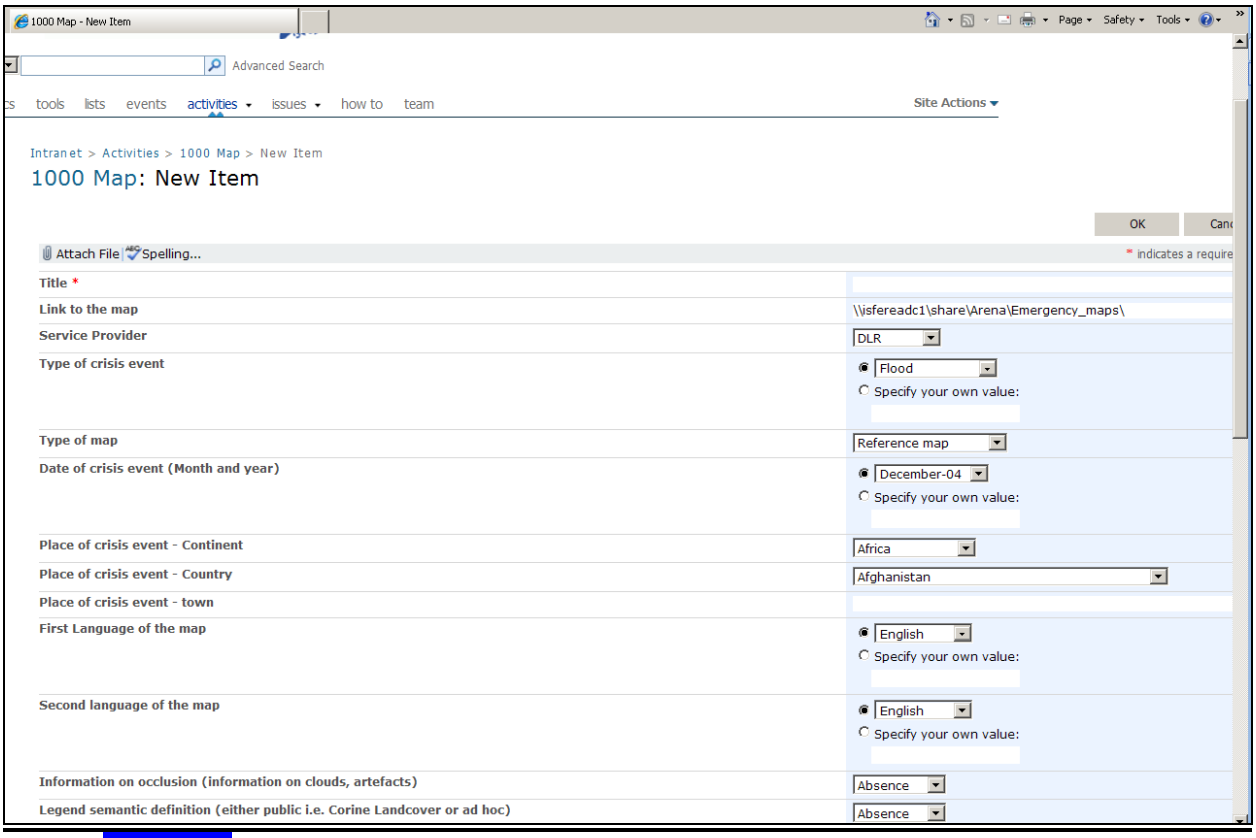
- For each event type and service provider, the maps have been organized by **year** of event. The date appears in the maps' name **after the ID** as in this example :

0010_**2008**_DLR_20080926_haiti_hurricane_bridge_Montrouis_medium.jpg
year= 2008

III- Validation Form

The validation form to be compiled is accessible through Isferea Intranet under "activities"
http://intranet/Activities/Lists/1000%20Map/Personal%20Records.aspx

1) To create a new form, click on **New** . The following form will appear. It contains a list of **43** attributes that will be used for the assessment of the maps. In most of cases to fill the attribute fields it is sufficient to choose between a list of values.



2) In the **Title(ID)** field: enter the map ID

3) In the **Link to the map field**, you should complete the already existing path, by putting the full link to the file under validation. Note that the first part of the existing path, **should not be modified**. You may copy it in your folder browser and directly access the maps on the G drive.

This is an example on how to complete this field:

\\isfereadc1\share\Arena\Emergency_maps\Earthquake\JRC**0226_2009_DLR_20100118_haiti_earthquake_correlation_rg_medium.jpg**

4) For the attribute **Type of map**, three different values are foreseen:

   a. Reference map: this value must be chosen when on the map there is no information about the crisis event; **i.e. Hydrology, population features, georeferenced EO data, infrastructure, administrative boundaries…**

   b. Crisis situation map: this value must be chosen when on the map describes in some way the crisis event; **i.e. Flooded, burnt areas, …**

   c. Damage assessment: this value must be chosen when on the map there is information about **affected population, settlements, infrastructures…**

5) Two major families of attributes have been defined :

- Attributes that require a simple check of the information provided in the map, to check its presence or absence (e.g. **Information on occlusion on EO sources (clouds, artifacts)**;

- Attributes that require a personal assessment by choosing one of the possible options in the drop list (e.g. for the attribute **Contrast between background and thematic entities,** it is possible to assess whether it's good/bad/fair).

6) The attribute **Legend semantic definition for thematic data (i.e. Corine Landcover)** requires verifying on the map the presence of a well known or ad hoc defined reference for legend items, in particular when describing thematic entities. This means that legend items meaning should be defined in a clear and objective way.

   For example to consider that the legend semantic is defined it should be clear from the legend:

   a) Earthquakes: how have the damage classes been defined? When a building is considered as "destroyed"? i.e. it can be defined according to an official damage scale (see EMS-98); or it should be described that is considered destroyed when the roof is collapsed, or when there is nothing more than rubble… If this is not specified the definition of "destroyed" could be subject to different interpretations.

   b) Flood: how has the flood water level been evaluated with respect to the standard one? Which minimum water level implies to consider an area as "flooded"?

   c) Fires: what is considered as burnt? Is it sufficient that the canopy of trees is burnt to consider an area as burnt?

   d) For Tsunami, Hurricane and Typhoon, see Flood and Earthquakes guidelines.

7) For the attribute **Consistency between map and legend symbols**; please check if all the symbols represented on the map are consistent with the symbols represented in the legend (i.e. no missing symbols or inconsistency in colour, shape or size representation).

8) The attribute **Time gap between crisis event and crisis image**, needs to be filled when a map is produced from EO data acquired in the context of a crisis event (post-event image). In that case, the date of image acquisition is normally mentioned on the map. To fill this attributes, you have to first enter the value of the time gap and then the unit (e.g. Value – "**2"**; Unit- "**Days"** for a time gap of two days between the crisis event and the date of image acquisition).

9) For the attribute **Spatial resolution of EO source (in meters)**: specify in meters the spatial resolutions of the satellite image used in the map production, when available. In case several images were used, please, indicate the value of the lowest spatial resolution.

10) For **Metadata - point of contact:** if both the website and the email of the point of contact are declared on the map then select **YES** from the drop list. In case only, the website is declared, then select **PARTIAL**.

11) Some maps (e.g. UNOSAT maps) have a glide number as in the following example. In the case, the glide number is available, it is necessary to enter it the **Glide Number** field.

Annex 2 – Validation parameters checklist

In the following table the values assumed by the validation parameters of the checklist are presented. The values in bold correspond to "fulfilment" of the validation parameters considered in the point e) of the assessment, as described in the document.

Field	Values
ID	
Link to the map	
Service Provider	
Type of crisis event	Conflict Earthquake Fire Flood Hurricane Landslide Mudslide security event total rainfall Tsunami Typhoon
Type of map	Crisis situation map Damage Assessment Reference map
Date of crisis event (Month and year)	
Date of map production (Month and year)	
Date of crisis event (Day, if present)	
Date of map production (Day, if present)	
Place of crisis event - Continent	A list of continents has been provided
Place of crisis event - Country	A list of countries has been provided
Place of crisis event - town	
First Language of the map	A list of the main spoken languages has been provided
Second language of the map	A list of the main spoken languages has been provided
Information on occlusion of EO sources (clouds, artifacts)	Absence Partial Info **Presence**
Legend semantic definition for thematic data (e.g. Corine Landcover)	Absence Partial Info **Presence**
Time gap between crisis event and crisis image - Value	
Time gap between crisis event and crisis image - Unit	
Spatial resolution of EO source (in meters)	
Consistency between map and legend symbols	Legend is absent No Partial **Yes**
Contrast between background and thematic entities	Bad Fair **Good**
Symbols easily differentiable	Bad Fair **Good**
Scale bar	No **Yes**

Field	Values
Declared scale	**Scale value** Legend is absent
Presence of overview map	No **Yes**
Coordinate Graticules/Grid and its labels	Absent Incomplete **Complete**
Presence of interpretation text	No **Yes**
Presence of map title	No **Yes**
Completeness of title: information on geographical area, date of event, thematic content	No Partial **Yes**
Type of map background	
Type of sensor used for information extraction (e.g. flood mask)	
Printing size	
Presence of name of producer	No **Yes**
Information on conditions related to access, use and information sharing	Nothing Copyright only Other conditions only **Copyright and other conditions**
Responsibility assumption (on a dataset or information sources)	Absent Disclaimer Partial **Present**
Metadata - Description of data sources used	No Partial **Yes**
Metadata - description of processing steps	No Partial **Yes**
Metadata - information on quality control procedure used	No Partial **Yes**
Metadata - information on known sources of error	No Partial **Yes**
Metadata - information on spatial accuracy	No Partial **Yes**
Metadata - information on thematic accuracy	No Partial **Yes**
Metadata - point of contact	No Partial **Yes**
Metadata - reference datum	No **Yes**
Metadata - reference projection	No **Yes**
Consistency between declared scale and resolution of the images used to produce the map	No **Yes**
Glide Number (When available) e.g. EQ-2010-000009-HTI	
Created By	
Modified By	

European Commission

EUR 24497 EN – Joint Research Centre – Institute for the Protection and Security of the Citizen
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Abstract
In the last decade, crisis maps have become increasingly a common support in the disaster preparedness and response cycle. In this work, five years of crisis maps from five world leader service providers have been explored and a way to extensively and quickly verify their quality is proposed. A sample of 255 maps has been assessed according to a checklist designed. The clarity of the content, the readability and usability of the maps and the respect of main cartographic standards have been assessed. The first analysis presented in this document highlighted that the basic characteristics expected in good maps are not always respected. The aim of showing current shortcomings in the crisis maps to the scientific community is to foster the improvement of their quality in the future.

The mission of the JRC is to provide customer-driven scientific and technical support for the conception, development, implementation and monitoring of EU policies. As a service of the European Commission, the JRC functions as a reference centre of science and technology for the Union. Close to the policy-making process, it serves the common interest of the Member States, while being independent of special interests, whether private or national.

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